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PRODUCTION COSTS OF OPERATING A 200 ACRE FIELD NURSERY IN OHIO--1985

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ABSTRACT

The objective of this paper was to determine annual production costs of operating a 200-acre field nursery in Ohio. This objective was accomplished by synthesizing a model field nursery using the conceptual framework of economic engineering. Annual production costs were about $1,130,000 for the 200-acre facility. Of the total, approximately $444,600 were fixed costs and $685,400 variable.

INTRODUCTION

To make more informed decisions as to whether to enter, leave, or expand field production, nurserymen require production,

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marketing and financial information. Comprehensive cost models have recently been developed for container grown crops in U.S.D.A. Plant Hardiness Zone 6 (3), for field grown crops in U.S.D.A Plant Hardiness Zones 7 and 8 (1), and for field grown crops in U.S.D.A. Plant Hardiness Zones 5 and 6 (2). The objective of this paper is to present annual costs of production for a 200-acre field nursery producing a diverse combination of shrubs and trees.

MATERIALS AND METHODS

A model firm was synthesized using the conceptual framework of economic engineering wherein the "best proven practice" was included for the model. The complete model included developing an appropriate production cycle; schematic drawings of the physical layout, including buildings and irrigation system; lists of equipment and other items; a complete sequence by month and year of nursery operational steps beginning with land preparation and ending with loading the finished product for wholesale distribution; and budgets for fixed and variable costs (2). Commonly grown nursery stock were divided into five cultural groups: slow growing evergreens, fast growing evergreens, deciduous shrubs, shade trees, and ornamental trees. While not all inclusive, the groups did permit a range of per unit costs to be developed as they related to input costs and cultural factors. One species of plant was chosen to represent each cultural group. The production system provided for propagating shrubs (Taxus,

Juniperus, and Viburnum) and for purchasing liners for trees (Acer rubrum and Malus).

Data for this study were obtained from wholesale nurseries and nursery suppliers in Ohio during the late Autumn and Winter of 1984 and the Spring of 1985. Price quotations obtained were for the 1985 production season. The basic goals in synthesizing production facilities were to minimize labor expenses, flow and movement of plant material and equipment, maximize the number of salable plants and allow future expansion. The nursery reported on consisted of 200 acres with 175 acres being growing space and 25 acres production facilities, holding area, field bed area and roads. Twenty percent of the growing space was assigned to each of the cultural groups.

Costs were established for all factors of production including management and invested capital (2). Since most nurseries use cash rather than accrual procedures, the analyses were completed on a "cash" basis. Capital requirements for establishing the nursery were first determined. Second, physical factors associated with the nursery and annual shipment requirements were established. Third production systems for the enterprises budgeted were described. Fourth, annual fixed costs were calculated (Table 1). Fifth, estimated variable costs for each of the five groupings of plants were determined. Sixth, each item contributing to variable costs for the five species was totaled for physical quantities and costs (Table 2).

RESULTS AND DISCUSSION

Annual fixed, variable, and total production costs of operating a 200 acre field nursery in Ohio for 1985 are summarized in Table 3. Total production costs were $1,129,917. Fixed costs totaled $444,525 and made up 39% of total annual costs. Based on a percentage of total costs, land and improvements made up 10%, buildings 3%, machinery and equipment 11%, general overhead 14%, and interest on general overhead, insurance, and taxes 1%. Variable costs totaled $685,392 and made up 61% of total costs. Based on a percentage of total costs, propagation made up 1%, materials 25%, machinery and equipment 8%, labor 24%, and interest on operating capital 3%.

Individual nurserymen might well experience costs different than those depicted here. Most cost differences would probably be reflected in fixed rather than variable costs. Budgets presented assumed new facilities, machinery, and equipment. Most nurserymen have owned their land for many years and have used machinery and equipment. For the established nursery, budgeted fixed costs presented here would reflect replacement rather than "book values" of depreciated items. Interest on investment items was also determined using the approximate rate charged by banks. Another method of computing interest charges would be to use the "real" rate which is the difference between what a bank charges and the rate of inflation (i.e. 12% bank rate of interest - 5% rate of inflation = 7% real interest rate). Yet another method

of computing interest would be to use the "real" interest rate computed on 50% of the cost of depreciable items. This latter method takes into account the "real" rate of interest and cost recovery of depreciable items. We choose the method we felt was most understandable to the majority of nurserymen. It does, however, overstate the cost of interest in most cases. Variable cost items, on the other hand, should be rather consistent regardless of age and size of nursery.

SUMMARY

Total annual production costs of operating a 200 acre field nursery were $1,129,917. Fixed costs were $444,525 or 39% of the total. Variable costs were $685,392 or 61% of the total.

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Table 1.--Annual Fixed Costs (Dollars) for a 200 Acre* Field Nursery, U.S.D.A. Plant Hardiness Zones Five and Six, 1985.

Item	Description	Depreciation**	Interest***	Insurance and Taxes****	Total
Land	Unimproved land	—	48,000	8,000	56,000
+ Improvements	Grading, tiling, graveling, pond	12,789	34,105	5,684	52,578
Subtotal		12,789	82,105	13,684	108,578
Buildings					
Office and restrooms	20′ x 40′	1,260	3,360	685	5,305
Plant and supply storage	40′ x 50′	1,800	4,800	978	7,578
Machinery storage and shop	40′ x 50′	1,800	4,800	978	7,578
Polyhouse structures (21 ea)	200′ x 20′	5,218	6,958	1,418	13,594
Subtotal		10,078	19,918	4,059	34,055
Machinery and Equipment					
Tractor, 100 HP	100 HP, diesel fuel	2,545	3,393	107	6,045
Tractor, 60 HP	60 HP, diesel fuel	1,838	2,450	77	4,365
Tractor, 34 HP (4 ea)	34 HP, gas fuel	5,221	6,962	219	12,402
Articulated 4-Wh. Dr. Loader (2 ea)	Swinger 220 - lift cap. = 2,000lbs	4,500	6,000	189	10,689
Articulated 4-Wh. Dr. Loader (2 ea)	Swinger 320 - lift cap. = 3,000lbs	6,840	9,120	287	16,247
Tree spade (2 ea)	530P Handles 20",22", & 24" + liftpads	7,641	2,038	64	9,743
Forks	For front-end loaders	396	528	17	941
Plow	3 - 14 inch plows	235	314	10	559
Disk	8′ wide	351	468	15	834
Harrow	10′ wide	59	78	2	139
Cultimulcher - bed area	10′ wide	342	456	14	812
Sprayrig (boom sprayer)	100 gallon tank with 10′ boom	181	169	5	355
Transplanter, 3 row	3-20 inch row bed transplanter	675	900	28	1,603
Transplanter, one row	Tree planter	450	600	19	1,069
Permanent irrigation/well pump	100 HP electric pump	1,638	4,367	138	6,143
Inground irrigation/bed area	PVC pipe/valves	1,557	4,153	131	5,841
Above ground irrigation/bed area	Aluminum pipe/valves/sprinklerheads	782	522	16	1,320
Inground irrigation storage/holding	PVC pipe/valves	808	2,155	68	3,031
Above ground irr. storage/holding	Aluminum pipe/valves/sprinklerheads	1,491	994	31	2,516
Traveler gun - field irrigation	450-500 gallons per minute	1,980	2,640	83	4,703
Portable irrigation pump	40 HP P.T.O irrigation pump/foot valve	38	51	2	91
Airblast sprayer	300 gallon high pressure on trailer	463	432	14	909
Fertilizer injector (2 ea)	26 gallon injector	307	205	6	518
Transplanter, 2 row	2-42 inch row field transplanter	504	672	21	1,197
U-Blade - field	18" for undercutting	43	29	1	73
Undercutter - bed	Bed undercutter, 50" blade, lift tines	37	34	1	72
Fertilizer sidedresser	2 row sidedresser	90	120	4	214
Cultivator, 2 row (2 ea)	2 row field cultivator	450	420	13	883
Wagon (8 ea)	4 wheel, farm wagon	1,424	1,899	60	3,383
Cultivator, 3 row	3 row bed cultivator	289	270	9	568
Truck (2 ea)	1/2 ton pickup truck	4,855	3,236	102	8,193
Pallets (482 ea)	Wooden	2,603	694	22	3,319
Handtools (76 Sets)	Miscellaneous	1,368	912	29	2,309
Seeder	Broadcast seeder	16	21	1	38
Mower	7′ - 3 blade mower	205	274	9	488

Table 1 Con't

Item	Description	Depreciation**	Interest***	Insurance and Taxes****	Total
Flatbed truck	24 ft. flatbed, gas fuel	7,560	5,040	159	12,759
Heating System for Propagation					
Gas fired unit heaters (2 ea)	2000,000 BTU (input)	199	265	8	472
Fan jet - Acme (2 ea)		19	24	1	44
Thermostat (2 ea)	Two stage	8	11	#	19
Set-up for propane (2 ea)	Vent., reg., etc.	18	24	1	43
Set-up for heating system (2 ea)	Plywood, braces, bolts, etc.	18	24	1	43
Other Propagation Materials					
Misting system (6 ea)	Mist-a-matic	672	179	6	857
Pipe and nozzles	For misting system	270	72	2	344
Treated boards	5/4" x 8" x variable length	440	117	4	561
Heater cable		567	151	5	723
Subtotal		61,993	63,483	2,001	127,477
Total for Depreciation, Interest Insurance and Taxes		84,815	165,386	19,740	270,110
General Overhead					
Utilities	Telephone, electric, gas heat				9,200
Licenses and bonds					600
General repairs and maintenance	Buildings, grounds, roads				12,200
Advertising and printing					1,800
Insurance, personnel##	Workmen's comp., FICA, health, unemp.				30,400
Travel and professional fees					2,725
Administrative and management###	Clerical, operator, supervisory, labor and office supplies				104,500
Miscellaneous					2,000
Subtotal					163,425
Interest on General Overhead Insurance, and Taxes	12% per annum for 6 months on a total of $183,169				10,990
Total Annual Fixed Costs					444,525

*Two hundred acre total, 175 acres growing space, 25 acres production facilities, holding area, field bed area, roads, etc.

**Depreciation was estimated by dividing initial cost adjusted for a 10% salvage value, by the years of useful life.

***Interest costs were estimated by multiplying the initial value of land, building, equipment and machinery by the interest rate, 12% per annum.

****Insurance and taxes.

Land and improvements--Only taxes are assessed, at a rate of $20.00 per $1000.00 of market value.

Buildings--Taxes are assessed at a rate of $20.00 per $1000.00 of market value. Insurance, $500.00 deductible, at $4.46 per $1000.00 of market value. Total for category, $24.46 per $1000.00.

Machinery and equipment--Taxes are not assessed in state of Ohio on personal property. Insurance, $500.00 deductible, at $3.78 per $1000.00 of initial value.

#Less than $0.50.

##Insurance for personnel was estimated at 32% of salaries for owner/operator, supervisors, and clerical.

###Owner/operator = $35,000, 2 Supervisors @ $20,000 ea. = $40,000, 2 Clerical @ $10,000 = $20,000, Supplies 10% or $9,500. Total = $104,500.

TABLE 2.--Variable Costs (Dollars) for a 200 Acre* Field Nursery, U.S.D.A Plant Hardiness Zones Five and Six, 1985.

Item	Description	Unit	Cost per Unit**	Quantity	Total Variable Cost
Propagation***					
Rooting media	Sand	cubic yd.	6.50	66.00	429
Collecting, stripping & sticking	135,231 units	hrs.	6.93****	152.78	1,059
Maintainance		hrs.	6.93	800.00	5,544
Harvest	135,231 units	hrs.	6.93	289.97	2,010
Hormone powder	#1, I.B.A. (Viburnum)	lbs.	8.00	1.49	12
	#3, I.B.A. (Juniperus)	lbs.	11.70	1.39	16
	#8, I.B.A. (Taxus)	lbs.	15.50	1.08	17
Subtotal					9,087
Materials					
Burlap	32" x 32" squares + twine (shrubs)	each	0.45	70,736.00	31,831
	54" x 54" squares-24" basket (Acer rubrum)	each	3.10	8,177.00	25,349
	54" x 54" squares-18" basket (Malus)	each	2.53	11,954.00	30,244
Twine	Nails & twine (trees)	each	0.15	20,131.00	3,020
Liners	Acer rubrum, 6-8' 2 yr branched	each	8.68	9,086.00	78,866
	Malus, 5-6' 2 yr branched	each	4.86	13,283.00	64,555
Polyethylene film	4 mil white, 32' x 225' (shrubs overwinter)	each	127.50	17.68	2,254
Strip tags	5/8" X 7" plastic strip tag	each	0.02	90,867.00	1,817
Poultry wire	1" for rabbit control (trees)	roll	29.00	18.00	522
Seed	Rye grass (Kentucky 31) (trees)	pound	0.64	3,430.35	2,195
Chemicals	Custom spread, custom blend: 45-0-0, 0-44-0, 0-0-60 (fertilizer)	ton	176.00	21.96	3,865
	Custom spread, (lime)	ton	20.00	35.53	711
	Urea, 45-0-0 (fertilizer)	ton	220.00	20.27	4,459
	Soluble 20-20-20 (fertilizer)	ton	1,411.20	1.35	1,905
	Trifluralin 4 EC (Treflan) (herbicide)	gallon	33.49	16.29	546
	Simazine 80WP (Princep) (herbicide)	pound	3.75	366.11	1,373
	DCPA 75WP (Dacthal) (herbicide)	pound	6.37	999.30	6,366
	Malathion, 57EL, (Cythion) (insecticide)	gallon	18.28	323.10	5,906
	Benomyl, 50 WP, (Benlate) (fungicide)	pound	14.17	271.20	3,843
	Carbaryl, 80WP (Sevin) (insecticide)	pound	6.09	459.65	2,799
	Chlorothalonil 10M cu. ft.(Termil) (fung.)	canister	1.76	53.00	93
	Other (i.e. Kelthane, Captan, Di-syston, Orthene, etc.)*****				6,308
Subtotal					278,827
Machinery and Equipment					
	Tractor, 100 HP	hour	17.00	493.33	8,387
	Tractor, 60 HP	hour	11.68	583.16	6,811
	Tractor, 34 HP	hour	4.99	631.20	3,150
	Articulated Loader/2,000lbs	hour	6.67	524.58	3,499
	Articulated Loader/3,000lbs	hour	14.81	525.17	7,778
	Tree Spade	hour	5.30	1,018.23	5,397
	Forks	hour	0.01	1,044.01	10
	Plow, 3-14"	hour	6.57	31.12	204
	Disk, 8' wide	hour	4.23	59.23	251
	Harrow, 10' wide	hour	8.45	4.66	39
	Cultimulcher, 10' wide	hour	24.70	8.76	216

Table 2 Cont.

Item	Description	Unit	Cost per Unit**	Quantity	Total Variable Cost
	Spray rig with 10' boom	hour	2.77	57.04	158
	Transplanter, one row (tree)	hour	0.92	406.71	374
	Transplanter, 3 row	hour	26.79	20.81	557
	Permanent irrigation/well & pump 100 HP	hour	7.60	323.00	2,455
	Inground irrigation - bed/field area	hour	3.13	221.50	693
	Above ground irrigation - bed area	hour	1.83	190.00	348
	Inground irrigation - storage & holding	hour	5.65	60.00	339
	Above ground irrigation - storage & hold.	hour	11.05	60.00	663
	Travler gun	hour	12.06	73.00	880
	Portable PTO pump, 40 HP (emergency)	hour	3.75	3.40	13
	Airblast sprayer	hour	1.01	405.15	409
	Fertilizer injector	hour	12.39	9.00	112
	Seeder	hour	1.05	10.72	11
	Mower	hour	2.98	42.84	128
	Transplanter, 2 row	hour	12.00	34.67	416
	Undercutter, bed	hour	1.16	20.00	23
	U Blade	hour	17.56	1.65	29
	Sidedresser, 2 row	hour	0.63	102.25	64
	Cultivator, 2 row	hour	.95	171.46	163
	Wagon, 4 wheel	hour	0.48	248.80	119
	Cultivator, 3 row	hour	13.93	14.75	205
	Truck, 1/2 ton pickup	hour	8.42	2,779.10	23,402
	Flatbed truck, 24' bed	hour	14.87	1,701.74	25,305
Subtotal					92,608
Labor					
	Labor hours	hour	6.93****	31,995.24	221,727
	Related labor hours, 20%	hour	6.93	6,399.28	44,347
Subtotal					266,074
Interest Charge on Operating Capital	Computed at 12% on an annual basis for 6 months	percent	6.0 (0.06)	646,596.00	38,796
Total Variable Costs					685,392

*Total Nursery - 200 acres; 175 acres of growing space, 25 acres production facilities, holding & field bed area, roads, etc.

**Quantity discounts were applied to chemicals and other items.

***135,231 plants would be stuck in the propagation house where about 23% would be lost leaving 104,024 for transplanting into liner beds. About 20% of the plants in the liner beds would be lost leaving 83,219 for transplanting into the field.

****Average basic wage before withholding taxes and fringes $5.25, taxes and fringes add 32% or $1.68 for a total of $6.93.

*****To achieve better pest and disease control, alternative chemical useage is advisable. Alternative chemical costs were estimated at 50% of the cost of Malathion, Benomyl, and Carbaryl.

Table 3.--Summary of Annual Fixed, Variable, and Total Costs (Dollars) of Operating a 200 Acre Field Nursery in Ohio, 1985.

Item	Cost	Percent of Total Cost
Fixed Cost Items		
Land and improvements	108,578	10
Buildings	34,055	3
Machinery and equipment	127,477	11
General overhead	163,425	14
Interest on general overhead insurance and taxes	10,990	1
Subtotal	444,525	39
Variable Cost Items		
Propagation (shrubs)	9,087	1
Materials	278,827	25
Machinery and equipment	92,608	8
Labor	266,074	24
Interest on operating capital	38,796	3
Subtotal	685,392	61
TOTAL	1,129,917	100